STL
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ANALYTICAL REPORT

JOB NUMBER: 993059

Prepared For:

ISSI, Incorporated
999 18th Street
Suite 1450
Denver, CO 80202

Attention: Adrian Bradley

Date: 12/01/1999

Signature

Date 12/27/99

Name: Wendell D. Fischer

Title: Laboratory Supervisor

Severn Trent Laboratories
10703 East Bethany Drive
Aurora, CO 80014

PHONE: (303) 751-1780
FAX..: (303) 751-1784

U.S. ENVIRONMENTAL PROTECTION AGENCY
Environmental Services Division

CHAIN OF CUSTODY RECORD

REGION VIII, ONE DENVER PLACE
999 18TH. STREET
DENVER, CO. 80202-2413

PROJ. NO.

PROJECT NAME: Arsenic Bioavailability

SAMPLERS: (Signature)

STAT. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	(24hr Exchange (9080/4081)	Total organic Carbon (9060)	pH (9045C)				REMARKS
1	11-3-99	1135	X		BI-00001	1	✓	✓	✓				
2	11-3-99	1135	X		BI-00002	1	✓	✓	✓				
3	11-3-99	1135	X		BI-00003	1	✓	✓	✓				
4	11-3-99	1135	X		BI-00004	1	✓	✓	✓				
5	11-3-99	1135	X		BI-00005	1	✓	✓	✓				
6	11-3-99	1135	X		BI-00006	1	✓	✓	✓				

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
	11-3-99 1140	Dale Gritton STL			
Relinquished by: (Signature)	Date/Time	Received by: (Signature) 11/4/99 1000	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks	
			11/4/99 1060		

Distribution: Original Accompanies Shipment: First Copy to Coordinator Field Files: Second Copy to Representative of Inspected Facility

Split Samples: ☐ Accepted ☐ Declined Signature

R8 EPA-014B (4-21-86)

8-31871

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SAMPLE INFORMATION
Date: 12/01/1999

Job Number.: 993059
Customer...: ISSI, Incorporated
Attn.....: Adrian Bradley

Project Number.....: 99000260
Customer Project ID....: ARSENIC BIOAVAIL.
Project Description....: TALs + Indium

Laboratory Sample ID	Customer Sample ID	Sample Matrix	Date Sampled	Time Sampled	Date Received	Time Received
993059-1	B1-00001	Soil	11/03/1999	11:35	11/04/1999	10:00
993059-2	B1-00002	Soil	11/03/1999	11:35	11/04/1999	10:00
993059-3	B1-00003	Soil	11/03/1999	11:35	11/04/1999	10:00
993059-4	B1-00004	Soil	11/03/1999	11:35	11/04/1999	10:00
993059-5	B1-00005	Soil	11/03/1999	11:35	11/04/1999	10:00
993059-6	B1-00006	Soil	11/03/1999	11:35	11/04/1999	10:00

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LABORATORY TEST RESULTS

Job Number: 993059 Date: 12/01/1999

CUSTOMER: ISSI, Incorporated PROJECT: ARSENIC BIOAVAIL. ATTN: Adrian Bradley

Customer Sample ID: B1-00001
Date Sampled.....: 11/03/1999
Time Sampled.....: 11:35
Sample Matrix.....: Soil

Laboratory Sample ID: 993059-1
Date Received.....: 11/04/1999
Time Received.....: 10:00

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	FLAGS	REPORTING LIMIT	UNITS	DATE	TECH
62-1.3.2.2	1:1 Soil Paste	Complete					11/09/99	mjf
ASA-9 90-3	Organic Carbon, Total (TOC), Solid	3.09			0.01	%	11/17/99	sjv
SW-846 9045C	pH, Solid	6.2			0.01	pH Units	11/09/99	mjf
SW-846 9081	Cation Exchange Capacity, Solid	15.7			0.05	meq/100gm	11/16/99	mjf

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LABORATORY TEST RESULTS

Job Number: 993059 Date: 12/01/1999

CUSTOMER: ISSI, Incorporated PROJECT: ARSENIC BIOAVAIL. ATTN: Adrian Bradley

Customer Sample ID: B1-00002
Date Sampled.....: 11/03/1999
Time Sampled.....: 11:35
Sample Matrix.....: Soil

Laboratory Sample ID: 993059-2
Date Received.....: 11/04/1999
Time Received.....: 10:00

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	FLAGS	REPORTING LIMIT	UNITS	DATE	TECH
62-1.3.2.2	1:1 Soil Paste	Complete					11/09/99	mjf
ASA-9 90-3	Organic Carbon, Total (TOC), Solid	4.10			0.01	%	11/17/99	sjv
SW-846 9045C	pH, Solid	6.5			0.01	pH Units	11/09/99	mjf
SW-846 9081	Cation Exchange Capacity, Solid	16.0			0.05	meq/100gm	11/16/99	mjf

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LABORATORY TEST RESULTS

Job Number: 993059 Date: 12/01/1999

CUSTOMER: ISSI, Incorporated PROJECT: ARSENIC BIOAVAIL. ATTN: Adrian Bradley

Customer Sample ID: B1-00003
Date Sampled.....: 11/03/1999
Time Sampled.....: 11:35
Sample Matrix.....: Soil

Laboratory Sample ID: 993059-3
Date Received.....: 11/04/1999
Time Received.....: 10:00

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	FLAGS	REPORTING LIMIT	UNITS	DATE	TECH
62-1.3.2.2	1:1 Soil Paste	Complete					11/09/99	mjf
ASA-9 90-3	Organic Carbon, Total (TOC), Solid	3.17			0.01	%	11/17/99	sjv
SW-846 9045C	pH, Solid	6.2			0.01	pH Units	11/09/99	mjf
SW-846 9081	Cation Exchange Capacity, Solid	14.4			0.05	meq/100gm	11/16/99	mjf

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LABORATORY TEST RESULTS

Job Number: 993059

Date: 12/01/1999

CUSTOMER: ISSI, Incorporated PROJECT: ARSENIC BIOAVAIL. ATTN: Adrian Bradley

Customer Sample ID: B1-00004
Date Sampled.....: 11/03/1999
Time Sampled.....: 11:35
Sample Matrix.....: Soil

Laboratory Sample ID: 993059-4
Date Received.....: 11/04/1999
Time Received.....: 10:00

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	FLAGS	REPORTING LIMIT	UNITS	DATE	TECH
62-1.3.2.2	1:1 Soil Paste	Complete					11/09/99	mjf
ASA-9 90-3	Organic Carbon, Total (TOC), Solid	2.63			0.01	%	11/17/99	sjv
SW-846 9045C	pH, Solid	6.8			0.01	pH Units	11/09/99	mjf
SW-846 9081	Cation Exchange Capacity, Solid	14.7			0.05	meq/100gm	11/16/99	mjf

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LABORATORY TEST RESULTS

Job Number: 993059 Date: 12/01/1999

CUSTOMER: ISSI, Incorporated PROJECT: ARSENIC BIOAVAIL. ATTN: Adrian Bradley

Customer Sample ID: B1-00005
Date Sampled.....: 11/03/1999
Time Sampled.....: 11:35
Sample Matrix.....: Soil

Laboratory Sample ID: 993059-5
Date Received.....: 11/04/1999
Time Received.....: 10:00

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	FLAGS	REPORTING LIMIT	UNITS	DATE	TECH
62-1.3.2.2	1:1 Soil Paste	Complete					11/09/99	mjf
ASA-9 90-3	Organic Carbon, Total (TOC), Solid	2.63			0.01	%	11/17/99	sjv
SW-846 9045C	pH, Solid	5.1			0.01	pH Units	11/09/99	mjf
SW-846 9081	Cation Exchange Capacity, Solid	10.6			0.05	meq/100gm	11/16/99	mjf

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LABORATORY TEST RESULTS

Job Number: 993059 Date: 12/01/1999

CUSTOMER: ISSI, Incorporated PROJECT: ARSENIC BIOAVAIL. ATTN: Adrian Bradley

Customer Sample ID: B1-00006
Date Sampled.....: 11/03/1999
Time Sampled.....: 11:35
Sample Matrix.....: Soil

Laboratory Sample ID: 993059-6
Date Received.....: 11/04/1999
Time Received.....: 10:00

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	FLAGS	REPORTING LIMIT	UNITS	DATE	TECH
62-1.3.2.2	1:1 Soil Paste	Complete					11/09/99	mjf
ASA-9 90-3	Organic Carbon, Total (TOC), Solid	2.40			0.01	%	11/17/99	sjv
SW-846 9045C	pH, Solid	5.6			0.01	pH Units	11/09/99	mjf
SW-846 9081	Cation Exchange Capacity, Solid	11.6			0.05	meq/100gm	11/16/99	mjf

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QUALITY CONTROL RESULTS

Job Number.: 993059 — Report Date.: 12/01/1999

CUSTOMER: ISSI, Incorporated — PROJECT: TALs + Indium — ATTN: Adrian Bradley

Test Method.....: SW-846 9081 — Batch.....: 54120 — Analyst...: mjf
Method Description.: Cation Exchange Capacity — Units.....: meq/100gm — Test Code.: CEC
Parameter.....: Cation Exchange Capacity

QC	Lab ID	Reagent	QC Result	Q	QC Result	True Value	Orig. Value	Calc. Result	*	Limits	F	Date	Time
ED	993059-6		10.14				11.64	13.8	R	20		11/16/1999	1200
MB			0.02	U						0.05		11/16/1999	1200

Test Method.....: ASA-9 90-3 — Batch.....: 53933 — Analyst...: sjv
Method Description.: Organic Carbon (Walkley Black) — Units.....: % — Test Code.: TOC
Parameter.....: Organic Carbon, Total (TOC)

QC	Lab ID	Reagent	QC Result	Q	QC Result	True Value	Orig. Value	Calc. Result	*	Limits	F	Date	Time
MD	993059-1		3.40				3.09	9.6	R	20		11/17/1999	1020
LCS		980605	0.84			1.00		84.0	%	71.8-129.0		11/17/1999	1020
MB			0.00	U						0.01		11/17/1999	1020

Test Method.....: SW-846 9045C — Batch.....: 53652 — Analyst...: mjf
Method Description.: Soil pH — Units.....: pH Units — Test Code.: PH
Parameter.....: pH

QC	Lab ID	Reagent	QC Result	Q	QC Result	True Value	Orig. Value	Calc. Result	*	Limits	F	Date	Time
CCV		990280	6.99			7.00		99.9	%	90-110		11/09/1999	1440
CCV		990280	6.98			7.00		99.7	%	90-110		11/09/1999	1440
ICV		G990802A	4.03			4.00		100.8	%	90-110		11/09/1999	1440
ED	993004-15		2.18				2.18	0.0	R	20		11/09/1999	1440

* %=% REC, R=RPD, A=ABS Diff., D=% Diff.

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ANALYTICAL SUMMARY REPORT

Job Number: 993059 Report Date: 12/01/19

CUSTOMER: ISSI, Incorporated PROJECT: ARSENIC BIOAVAIL. ATTN: Adrian Bradley

BATCH	53648	ANALYTICAL METHOD	62-1.3.2.2	DESCRIPTION	Soil Paste	ANALYST	mjf

Lab Sample ID	Client Sample Identification	Sample Matrix	Test Matrix	Sample Date	Sample Time	Analysis Date	Analysis Time	Dil/Corr. Factor
993059-1	B1-00001	Soil		11/03/99	1135	11/09/99	1000	1
993059-2	B1-00002	Soil		11/03/99	1135	11/09/99	1000	1
993059-3	B1-00003	Soil		11/03/99	1135	11/09/99	1000	1
993059-4	B1-00004	Soil		11/03/99	1135	11/09/99	1000	1
993059-5	B1-00005	Soil		11/03/99	1135	11/09/99	1000	1
993059-6	B1-00006	Soil		11/03/99	1135	11/09/99	1000	1

BATCH	53933	ANALYTICAL METHOD	ASA-9 90-3	DESCRIPTION	Organic Carbon (Walkley Black)	ANALYST	sjv

Lab Sample ID	Client Sample Identification	Sample Matrix	Test Matrix	Sample Date	Sample Time	Analysis Date	Analysis Time	Dil/Corr. Factor
993059-1	B1-00001	Soil	Solid	11/03/99	1135	11/17/99	1020	1
993059-2	B1-00002	Soil	Solid	11/03/99	1135	11/17/99	1020	1
993059-3	B1-00003	Soil	Solid	11/03/99	1135	11/17/99	1020	1
993059-4	B1-00004	Soil	Solid	11/03/99	1135	11/17/99	1020	1
993059-5	B1-00005	Soil	Solid	11/03/99	1135	11/17/99	1020	1
993059-6	B1-00006	Soil	Solid	11/03/99	1135	11/17/99	1020	1

BATCH	53652	ANALYTICAL METHOD	SW-846 9045C	DESCRIPTION	Soil pH	ANALYST	mjf

Lab Sample ID	Client Sample Identification	Sample Matrix	Test Matrix	Sample Date	Sample Time	Analysis Date	Analysis Time	Dil/Corr. Factor
993059-1	B1-00001	Soil	Solid	11/03/99	1135	11/09/99	1440	1
993059-2	B1-00002	Soil	Solid	11/03/99	1135	11/09/99	1440	1
993059-3	B1-00003	Soil	Solid	11/03/99	1135	11/09/99	1440	1
993059-4	B1-00004	Soil	Solid	11/03/99	1135	11/09/99	1440	1
993059-5	B1-00005	Soil	Solid	11/03/99	1135	11/09/99	1440	1
993059-6	B1-00006	Soil	Solid	11/03/99	1135	11/09/99	1440	1

BATCH	54120	ANALYTICAL METHOD	SW-846 9081	DESCRIPTION	Cation Exchange Capacity	ANALYST	mjf

Lab Sample ID	Client Sample Identification	Sample Matrix	Test Matrix	Sample Date	Sample Time	Analysis Date	Analysis Time	Dil/Corr. Factor
993059-1	B1-00001	Soil	Solid	11/03/99	1135	11/16/99	1200	1
993059-2	B1-00002	Soil	Solid	11/03/99	1135	11/16/99	1200	1
993059-3	B1-00003	Soil	Solid	11/03/99	1135	11/16/99	1200	1
993059-4	B1-00004	Soil	Solid	11/03/99	1135	11/16/99	1200	1
993059-5	B1-00005	Soil	Solid	11/03/99	1135	11/16/99	1200	1
993059-6	B1-00006	Soil	Solid	11/03/99	1135	11/16/99	1200	1

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QUALITY ASSURANCE METHODS

REFERENCES AND NOTES

Report Date: 12/01/19

(1) EPA 600/4-79-020 Methods for Chemical Analysis of Water and Wastes, March 1983

(2) EPA 600/4-91/010 Methods for the Determination of Metals In Environmental Samples, June 1991 & Supplement 1, May 1994

(3) EPA SW846 Test Methods for Evaluating Solid Waste, Third Edition, September 1986; Update I, July 1992; Update II, September 1994; Update IIA, August 1993; Update IIB, January 1995; Update III, December 1996

(4) Standard Methods for the Examination of Water and Wastewater, 16th Edition (1985), 17th Edition (1989), & 18th Edition (1992)

(5) EPA 600/4-80-032 Prescribed Procedures For Measurement Of Radioactivity in Drinking Water, August 1980

(6) EPA 600/8-78-017 Microbiological Methods For Monitoring The Environment, December 1978

(7) HACH Method 8000 Chemical Oxygen Demand for Water & Wastewater

(8) Federal Register, July 1, 1990 (40 CFR Part 136)

(9) EPA 600/4-88-03 Methods For The Determination of Organics Compounds in Drinking Water, December 1988

(10) U.S.G.S. Methods For Determination of Inorganic Substances In Water And Fluvial Sediments, Book 5, Chapter A1, 1985

(11) Federal Register, June 7, 1991 (40 CFR Parts 141 & 142)

(12) ASTM Section 11 Water and Environmental Technology, Volume 11.01 Water (1), 1991

(13) Methods of Soil Analysis, American Society of Agronomy, Agronomy No. 9, 1965

(14) ASTM Section 5, Petroleum Products, Lubricants, and Fossil Fuels, Volume 05.05, Gaseous Fuels, Coal, and Coke

(15) EPA 600/2-78-054 Field and Laboratory Methods Applicable To Overburdens and Mine Soils, March 1978

(16) ASTM Part 19, Soils and Rocks; Building Stones, 1981

COMMENTS

a) ND = Not detected. NC = Not calculable due to value(s) lower than the detection limit.

b) The report cover sheet is not paginated and is included as part of the final report.

c) Data in the QA report may differ from final results due to digestion and/or dilution of samples into analytical ranges. Quality control results are reported "as analyzed" within the instruments established calibration range.

d) The "Time Analyzed" in the QA report refers to the start time of the analytical batch which may not reflect the actual time of each analysis. The "Date Analyzed" is the actual date of analysis.

e) Results for soil and sludge samples are reported on a wet weight basis (i.e. not corrected for percent moisture) unless otherwise indicated.

f) Column confirmation analysis is not performed for GC volatiles parameters unless specified by contract.

BLANK QC SAMPLE IDENTIFICATION

MB	Method Blank
EB	Extraction Blank
ICB	Initial Calibration Blank
CCB	Continuing Calibration Blank

SPIKE QC SAMPLE IDENTIFICATION

MS	Method (Matrix) Spike
MSD	Method (Matrix) Spike Duplicate
PDS	Post-Digestion Spike
PSD	Post-Digestion Spike Duplicate
SB	Spike Blank
SBD	Spike Blank Duplicate

REFERENCE STANDARD QC SAMPLE IDENTIFICATION

LCS	Laboratory Control Standard
LCD	Laboratory Control Standard Duplicate
RS	Reference Standard
RSD	Reference Standard Duplicate
ICV	Initial Calibration Verification Standard
CCV	Continuing Calibration Verification Standard
ISA/ISB	ICP Interference Check Sample
ICL	Initial Calibration/Laboratory Control Sample
DSC	Distilled Standard Check
CRI	CRDL Low-Level ICP Standard

DUPLICATE QC SAMPLE IDENTIFICATION

MD	Method (Matrix) Duplicate
ED	Extraction Duplicate
SD	Serial Dilution

Analyses performed by a subcontract laboratory are indicated on the analytical and/or quality control reports under "Technician" using the following codes:

SUBCONTRACT LABORATORY	CODE
Core Laboratories - Anaheim, CA	* AN
Core Laboratories - Casper, WY	* CA
Core Laboratories - Corpus Christi, TX	* CC
Core Laboratories - Gulf States - Houston, TX	* HE
Core Laboratories - Houston, TX	* HP
Core Laboratories - Lake Charles, LA	* LC
Core Laboratories - Valparaiso, IN	* VP
Other Subcontract Laboratories	* XX

EXPLANATION OF DATA QUALIFIERS - ORGANIC PARAMETERS

U - This qualifier indicates that the analyte was analyzed for but not detected.

J - Organic GC/MS Methods: This qualifier indicates that the value is an estimate. It is used when a compound is determined to be present based on the mass spectral data but at a concentration below the practical quantitation limit of the method.

J - Organic GC Methods: This qualifier indicates presumptive evidence of the presence of the compound at an estimated quantity.

E - This qualifier indicates that a sample result is an estimate because the concentration exceeded the upper calibration range of the instrument.

EXPLANATION OF DATA QUALIFIERS - METALS & INORGANIC PARAMETERS

U - This qualifier indicates that the analyte was analyzed for but not detected.

B - This qualifier indicates that the analyte was detected at a level below the reporting limit but greater than or equal to the instrument detection limit.

EXPLANATION OF DATA FLAGS - ALL PARAMETERS

B - This flag indicates that an analyte is present in the method blank as well as in the sample. The client should consider this when evaluating the data.

E - This flag indicates the reported value is estimated due to sample matrix interference.

W - This flag indicates that a post-digestion spike for GFAA analysis is outside quality control limits.

X - This flag indicates that a surrogate recovery is outside quality control limits.

Y - This flag indicates a spike or spike duplicate recovery is outside quality control limits.

Z - This flag indicates a relative percent difference for a spike and spike duplicate is outside quality control limits.

* - This flag indicates a relative percent difference for a duplicate analysis is outside quality control limits.

CORE LABORATORIES

pH & ALKALINITY

☒ EPA Methods 150.1, 9045, & 310.1
☒ Standard Methods 17TH Edition 2320 B
SOPs HC-ATM-E132, HC-ATM-E131, & HE-ATM-E081

Analyst M. FAGAN Date/Time 11/9/99 1440

Reviewed By P. Ellis Date 11/10/99

QA #53653 - 9045C
53653 - 150.1
53654 - 310.1
53655 - 2320B

Normality of HCl (990533) 0.01N

Detection Limits: Alkalinity 5 mg/L CO3 1 mg/L
HCO3 5 mg/L OH 1 mg/L

pH Meter Calibration

Buffer & KHP Standards

Buffer Conc. 4.00 (990304), 7.00, 10.00 (990376)

ICV KHP Std. ID & Conc. G990802A 4.00

CCV Buffer Conc. 990280 7.00

LCS Std. ID & Conc. G990106A 100 mg/L

pH Reading (pH Units) & % Recovery

4.01, 7.00, 10.01

4.03

Meter ID Orion 710A 990216

Slope 97.6

Sample ID	Sample Volume (mls)	Initial pH	Burette Readings (mls)				Alkalinity Results (mg/L)			
			Initial	pH 8.3	pH 4.5	Net	Total	CO_3	HCO_3	OH
Method Blank	25mls	6.13	0.0	-	0.1	0.1	<5	<1	<5	<1
LCS Standard	↓	10.41	0.1	-	4.6	4.5	90			
993004 - 15	1:1	2.18								
-15 ED		2.18								
-16		2.18								
-17		2.12								
-18		2.27								
↓ -19		2.69								
993059 - 1		6.15								
-2		6.52								
-3		6.21								
↓ -4	↓	6.85								
CCV	NA	6.98								

Comments:

NOTE: Continued on back of page.

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ALKALIN.LOG 8/8

CORE LABORATORIES

MA 4/19/99

Sample ID	Sample Volume (mls)	Initial pH	Burette Readings (mls)				Alkalinity Results (mg/L)			
			Initial	pH 8.3	pH 4.5	Net	Total	CO_3	HCO_3	
993059-5	1:1	5.13								
↓ -6	↓	5.64								
CCV	NA	6.99								
992992-2 *	25mls	8.22	0.0	-	6.5	6.5	1,300	<1	~~1,590~~ 1,590	
-2mb *		8.22	6.5	-	12.8	6.3	1,260	<1	1,540	<
-3 *		8.43 (8.46)	12.8	12.9 (0.1)	19.0	6.2	1,240	24	1,460	<
-4 *		8.51 (8.53)	19.0	19.1 (0.1)	25.2	6.2	1,240	24	1,460	<
-5 *		8.43 (8.42)	25.2	25.3 (0.1)	31.7	6.5	1,300	24	1,540	<
-6 *		8.45 (8.46)	31.7	31.8 (0.1)	37.9	6.2	1,240	24	1,460	<
-7 *		8.49 (8.50)	37.9	38.0 (0.1)	44.4	6.5	1,300	24	1,540	<
-8 *		8.37 (8.37)	0.0	-	6.6	6.6	1,320	<1	1,610	<
-9 *		8.45 (8.45)	6.6	6.7 (0.1)	12.9	6.3	1,260	24	1,490	<
↓ -10 *	↓	8.46 (8.50)	12.9	-	19.5	6.6	1,320	<1	1,610	<
CCV	NA	6.98								
992006-1	25mls	7.38	4.6	-	6.5	1.9	38	<1	46	<1
↓ -1mb	↓	7.34	6.5	-	8.5	2.0	40	<1	49	<1

Comments: * USED 0.1N HCL (990223)

Continued to pg 197

Total Alkalinity as $CaCO_3$ (mg/L) = $\frac{\text{Volume HCl (mls)} \times \text{Normality HCl} \times 50{,}000}{\text{Sample Volume (mls)}}$

Conversion Factors
OH as $CaCO_3$ X 0.34 = OH mg/L
CO_3 as $CaCO_3$ X 0.60 = CO_3 mg/L
HCO_3 as $CaCO_3$ X 1.22 = HCO_3 mg/L

ALKALINITY RELATIONSHIP

RESULT OF TITRATION	OH as $CaCO_3$	CO_3 as $CaCO_3$	HCO_3 as $CaCO_3$
P = 0	0	0	T
P < ½ T	0	2 P	T − 2 P
P = ½ T	0	2 P	0
P > ½ T	2 P − T	2 (T − P)	0
P = T	T	0	0

P = Phenolphthalein Alkalinity at pH 8.3
T = Total Alkalinity at pH 4.5

CORE LAB

CORE LABORATORIES

pH & ALKALINI

☒ EPA Methods 150.1, 9045, & 31
☒ Standard Methods 17TH Edition 232
SOPs HC-ATM-E132, HC-ATM-E131, & HE-ATM-E(

Continued from pg 196 MJ 11/4/99

Analyst ______ Date/Time ______

QA #

Reviewed By ______ Date ______

Normality of HCl ______

Detection Limits: Alkalinity 5 mg/L, CO3 1 mg/L, HCO3 5 mg/L, OH 1 mg/L

pH Meter Calibration

Buffer & KHP Standards		pH Reading (pH Units) & % Recovery	
Buffer Conc.			
ICV KHP Std. ID & Conc.			
CCV Buffer Conc.		Meter ID	
LCS Std. ID & Conc.		Slope	

Sample ID	Sample Volume (mls)	Initial pH	Burette Readings (mls) Initial	pH 8.3	pH 4.5	Net	Alkalinity Results (mg/L) Total	CO_3	HCO_3	OH
Method Blank										
LCS Standard										
993010-1 *	100mls	4.55 (4.39)	0.00	(4.5) 0.22	(-0.3) 0.53	0.32 (0.31)	<5	—	—	
-2 *	↓	4.73 (4.75)	0.00	(4.5) 0.25	(-0.3) 0.60	0.25 0.44	<5	—	—	
-3 *	↓	5.00 (5.01)	0.00	(4.5) 0.20	(-0.3) 0.51	0.26 0.31	<5	—	—	
-4 *	↓	5.25 (5.25)	0.00	(4.5) 0.23	(-0.3) 0.54	0.23 0.31	<5	—	—	
993023-1	25mls	7.55	8.5	—	10.7	2.2	44	—	—	
993022-3 *	↓	8.57 (8.55)	19.4	19.6 (0.2)	26.4	7.0	1400	48	1,610	<1
-5 *	↓	8.51 (8.51)	26.4	26.5 (0.1)	32.7	6.3	1,260	24	1,490	<1
-6 *	↓	8.63 (8.65)	32.7	32.8 (0.1)	39.4	6.7	1,340	24	1,590	<1
CCV	NA	6.99	—	—	—	—	—	—	—	—

Comments: * used 0.1N HCL (990323)

☆ low Alk used = (total mls of Acid) − mls to reach 0.3pH) × Acid N × 50,000 / mls of Sample

NOTE: Continued on back of page.

ALKALIN.LOG

CORE LABORATORIES

Sample ID	Sample Volume (mls)	Initial pH	Burette Readings (mls)				Alkalinity Results (mg/L)			
			Initial	pH 8.3	pH 4.5	Net	Total	CO_3	HCO_3	OH
Comments:										

Total Alkalinity as $CaCO_3$ (mg/L) = $\frac{\text{Volume HCl (mls) x Normality HCl x 50,000}}{\text{Sample Volume (mls)}}$

Conversion Factors

OH as $CaCO_3$ X 0.34 = OH mg/L
CO_3 as $CaCO_3$ X 0.60 = CO_3 mg/L
HCO_3 as $CaCO_3$ X 1.22 = HCO_3 mg/L

ALKALINITY RELATIONSHIP

RESULT OF TITRATION	OH as $CaCO_3$	CO_3 as $CaCO_3$	HCO_3 as $CaCO_3$
P = 0	0	0	T
P < ½ T	0	2 P	T − 2 P
P = ½ T	0	2 P	0
P > ½ T	2 P − T	2 (T − P)	0
P = T	T	0	0

000198

P = Phenolphthalein Alkalinity at pH 8.3
T = Total Alkalinity at pH 4.5

CSC
9081

1200 11/4/99
M. Faynor

Sample	Aliq
9983059 -1	4.0 g
-2	
-3	
-4	
-5	
-6	
-6D	

Reviewed by: D. Ellman
Date: 11/20/99

JECT # W #54120

G-IN DATE 11/22/99

TE DUE 11/16/99

CORE LABORATORIES LAB WORKSHEET

		D.LOC	D.L.IN		HB	993059-1	993059-2	993059-3	993059-4	993059-5	993059-6	993059(6 ES)					
					1	2	3	4	5	6	7	8	9	10	11	12	
DISSOLVED METALS																	
Calcium (Ca)	mg/1	100	.01								11.64						
Magnesium (Mg)	mg/1	101	.01		0.022	15.72	16.02	14.36	14.68	10.60	~~7.88~~ 7.87	10.14					
Sodium (Na) ⟶	mg/1	103	.01		0.203	144.6	147.3	132.01	135.01	97.44	72.47	93.29					
Potassium (K)	mg/1	102	.01								107.09 ← RCheck						
Aluminum (Al)	mg/1	107	.1														
Antimony (Sb)	mg/1	163	.01														
Arsenic (As)	mg/1	120	.01														
Barium (Ba)	mg/1	104	.1														
Beryllium (Be)	mg/1	178	.01														
Bismuth (Bi)	mg/1	189	.01														
Boron (B)	mg/1	97	.05														
Cadmium (Cd)	mg/1	115	.01														
Cadmium (Cd)	ug/1	199	10														
Chromium +6(Cr)	mg/1	260	.01														
Chromium +3(Cr)	mg/1	261	.01														
Chromium (Cr)	mg/1	112	.01														
Cobalt (Co)	mg/1	180	.05														
Copper (Cu)	mg/1	117	.01														
Gallium (Ga)	mg/1	32	.5														
Germanium (Ge)	mg/1	191	.1														
Gold (Au)	mg/1	38	.01														
	mg/1	106	.05														

7/99
SYNRD
530

1.1 PST

1000 11/9/99
M. Taylor
53648
~~53647~~ MT 11/9/99
53649

Finish Filter:
11/10/99 1130

Sample	Aliquot
~~993004~~-15	25g/25mLs
-16	
-17	
-18	
-19	
993059 - 1	15g/15mLs
- 2	
- 3	
- 4	
- 5	
- 6	
993054 - 1	95g/95mLs
- 2	91g/91mLs
- 3	95g/95mLs
- 4	90g/90mLs
- 5	140g/140mLs
- 6	90g/90mLs
- 6(D)	60g/60mLs
- 7	90g/90mLs
- 8	90g/90mLs
EB	108mLs
993065 - 1	90g/90mLs
- 2	90g/90mLs

Reviewed by: D Ellin
Date. 11/10/99

STOC 90.3
DL: 0.01

SMID = 980605

NFeSO4 = 0.3876

S. Vernon Overmeier
11/17/98 1020
QA# 53933

Sample	Amount (g)	mls FeSO4	%Org C	% Rec
MB	0.00	0.0 - 12.9 = 12.9	< 0.01	
MB	↓	12.9 - 25.8 = 12.9 (12.9)		
MB		25.8 - 38.7 = 12.9		
LCS	0.90	0.0 - 10.2 = 10.2	0.84	84%
993059-1	0.20	10.2 - 19.1 = 8.9	3.09	
-1MD		26.7 - 35.2 = 8.5	3.40	10%
-2		19.1 - 26.7 = 7.6	4.10	
-3		35.2 - 44.0 = 8.8	3.17	
-4		0.0 - 9.5 = 9.5	2.63	
-5		9.5 - 19.0 = 9.5	2.63	
-6	↓	19.0 - 28.8 = 9.8	2.40	

$$N\ FeSO_4 = \frac{(V \cdot N)K_2Cr_2O_7}{V\ FeSO_4}, \quad 5\ mls\ of\ 1\ N\ K_2Cr_2O_7\ used$$

$$\%\ Org\ C = \frac{\left[\left(V_{K_2Cr_2O_7} \cdot N_{K_2Cr_2O_7}\right) - \left(V_{FeSO_4} \cdot N_{FeSO_4}\right)\right] K\ 0.3 \times 1.33}{grams\ of\ sample}, \quad \begin{matrix}5\ mls\ of\\ 1\ N\\ K_2Cr_2O_7\\ used\end{matrix}$$

Reviewed by: _____
Date: 11/17/98

lv 11/17/98

CORE LABORATORIES, INC.

Anaheim, California
1250 E. Gene Autry Way
Anaheim, California 92805
(714) 937-1094

Aurora (Denver), Colorado
10703 E. Bethany Drive
Aurora, Colorado 80014
(303) 751-1780

Casper, Wyoming
420 West 1st Street
Casper, Wyoming 82601
(307) 235-5741

Corpus Christi, Texas
1733 North Padre Island Drive
Corpus Christi, Texas 78408
(512) 289-2673

Houston, Texas
8210 Mosley Road
Houston, Texas 77075
(713) 943-9776

Lake Charles, Louisiana
3645 Beglis Parkway
Sulphur, Louisiana 70663
(318) 583-4926

Long Beach, California
3700 Cherry Avenue
Long Beach, California 90807
(310) 595-8401

Sample Receipt Acknowledgment

Date 11/04/1999

Report To:
ISSI, Incorporated
999 18th Street
Suite 1450
Denver, CO 80202
Adrian Bradley

Invoice To:
ISSI, Incorporated
999 18th Street
Suite 1450
Denver, CO 80202
Adrian Bradley

Core Laboratories Job Number	Customer Project ID	Estimated Completion Date
993059		11/18/1999

Sample #	Customer ID	Remarks
1	B1-00001	
2	B1-00002	
3	B1-00003	
4	B1-00004	
5	B1-00005	
6	B1-00006	

THIS IS NOT AN INVOICE

Order subject to our sales agreement, if any.
Otherwise subject to our current terms of sale as shown on reverse side.
Please contact laboratory immediately, if any discrepancies are observed.

White - Customer Blue - Job File

CORE LABORATORIES
GENERAL TERMS AND CONDITIONS (1/96)

1.Acceptance. Core Laboratories (hereinafter referred to as "Core") offers and will accept orders for services (as defined herein) only under the following General Terms and Conditions (the "Terms"). These Terms shall not apply if Core and the Customer shall have executed a separate agreement in writing which does not incorporate the Terms. No modifications to the Terms shall be valid and binding unless in writing and signed by an authorized representative of Customer and Core. Customer's order for services shall be subject to the Terms and the Terms shall be binding upon Core by signature of its authorized representative or by Core's performance of Customer's order. For purpose of this Agreement, "services" shall mean all work to be performed for Customer, including provision of all equipment and materials to be furnished by Core.

2.Independent Contractor. Core acts solely as an independent contractor in performing services.

3.Customer Responsibility. Customer shall at all times be responsible for the complete care, custody, and control of the well, drilling or sampling site (the "Site"). Therefore, Customer is responsible for conditions in and about the Site and for advising Core of the same and of all information required to enable Core to perform its services safely and efficiently.

4.No Warranties. Core makes no warranty or representation, express or implied (by statute or otherwise), or guarantee of results from the performance of services pursuant to this Agreement. In providing services, Core's employees will exercise their best judgment under the prevailing conditions as they have observed and understand them using accepted standards and normal operating procedures. Any information, recommendation, interpretation, or opinion by Core is based upon inferences and assumptions which are subject to error, and with respect to which analysis may differ. Accordingly, Core does not assume any liability with respect to the use of, or for damages resulting from the use of, any information, data, test results, analysis, apparatus, method, or process disclosed by Core. In no event shall Core's liability under this Agreement or in connection with any service hereunder exceed the amount of compensation received by Core under this Agreement in payment for the services which are the subject matter of the alleged liability. To the maximum extent permitted by applicable law, Core negates and disclaims all implied warranties whatsoever, including, without limitation, all implied warranties of MERCHANTABILITY, CONDITION, DURABILITY, DESIGN, CAPACITY, OPERABILITY, NO REDHIBITORY DEFECTS, OR FITNESS FOR A PARTICULAR PURPOSE.

5.Hold Harmless. Customer releases and shall save, indemnify, defend and hold Core, its employees, officers, directors, agents, affiliates, subsidiaries, and each parent of Core (Core and each of said employees, officers, directors, agents, affiliates, subsidiaries, and each parent of Core being herein called an "Indemnified Person") harmless from and against any and all liabilities, losses or damages, claims, demands, causes of action, suits and associated expenses including, but not limited to all court costs, expert witness fees, investigative expenses and attorneys' fees (the "Litigation Expenses"), and awards arising in favor of Customer or any third party as a result of, and/or in any way occurring, incident to, arising out of, or in connection with the performance of services by Core pursuant to this Agreement and/or the transportation, handling, or disposal of Customer's Hazardous Materials: (i) injury, disease, or death to persons, (ii) damage to, loss of, or loss of use of property (including subsurface formations, downhole damage, or other underground damage, pollution damage to any surface or subsurface area or water, surface damage arising from underground damage, or damage to any rig or platform or injury to any well, wellbore, or Site), and/or (iii) financial loss of every kind or character.

This indemnity shall not apply to any of the foregoing losses, costs, damages, or injuries caused solely by the gross negligence or willful misconduct of Core or its employees. Further, this indemnity shall specifically apply to losses, claims, damages, liabilities, awards, demands, Litigation Expenses, suits or causes of action of every kind and character arising out of or in connection with the negligence of or breach of contract by any Indemnified Person, whether actual or alleged, in the performance of services under this Agreement. The foregoing indemnities will be in addition to any liability which the Customer might otherwise have in Core and the other Indemnified Persons. To the extent necessary under applicable law, Customer agrees that its indemnity obligation will be supported by available liability insurance coverage to be furnished by Customer, which insurance shall be in the maximum amounts permitted under applicable law.

In no event shall Core be liable to Customer for indirect, punitive, special, incidental, or consequential damages (including, without limitation, loss of profit or business interruption). Litigation Expenses or other fees (including, without limitation, attorneys' fees, court costs, and/or pre- or post-judgment interest), or any other expenses or costs incurred by Customer or any other party in any litigation against or involving Core or any Indemnified Person in connection with this Agreement or any service provided under this Agreement even if Customer is the prevailing party.

6.Hazardous Substances. In order for Core to perform the services requested by Customer, Customer will provide and Core will receive sample materials for analyses such as asbestos, polychlorinated biphenyls, or any other hazardous or toxic materials, wastes and substances which are defined, determined or identified as such under any federal, state or local laws, rules or regulations (whether now existing or hereafter enacted or promulgated) or any judicial or administrative interpretation of any thereof (the "Hazardous Materials"). Customer understands and agrees that any Hazardous Materials received by Core from Customer or at Customer's request shall remain the property of Customer and that upon completion of Core's services Core will dispose of all unused portions of samples as specified by Customer. In the event Customer does not specify its preferred method of disposal, Core will return to Customer all unused samples which contain Hazardous Materials, excluding finished gasoline and diesel samples. Core reserves the right to charge Customer for the disposal of unused samples in accordance with Core's current sample disposal policy.

7.Access to Well, Drilling, or Sampling Site. With respect to onshore or offshore operations, Customer shall arrange for and provide, at its expense, safe and adequate means of transportation as required for Core's personnel and equipment to gain access in or return from a Site and shall obtain at Customer's sole cost and expense all permits, licenses or other authorization required for Core to enter upon said Site for the purposes contemplated. When necessary to repair roads or bridges to move Core's equipment or personnel, such shall be arranged and paid for by Customer.

8.Storage. Customer shall provide safe and proper storage space at the Site, meeting all applicable safety and security requirements consistent with good industry practices, for Core's equipment and materials, if any.

9.Confidentiality. (a) Data and the sample materials provided by Customer or at Customer's request and the results obtained by Core shall be held in confidence (unless such information is generally available to the public or is in the public domain or Customer has failed to pay Core for all services rendered or is otherwise in breach of this Agreement) subject to any disclosure required by law or legal process. Core shall use the same standard of care it uses in protecting its own confidential data and shall not be responsible for unauthorized disclosure of said data where such standard was observed.

(b) Core's reports and the data and information provided therein are for the exclusive use and benefit of Customer and Customer agrees there shall be no third party beneficiary of such reports, data, or information. Customer will not disclose to any third party any information concerning Core's technical information, software programs, or other formulations.

10.Prices/Payment. Customer shall pay Core in accordance with Core's applicable Price Schedule in effect in the area of operations on the date the services are rendered. The Price Schedule is subject to change at any time without notice. Terms for payment of charges are NET CASH within thirty (30) days from date of invoice, in accordance with payment instructions on the invoice. To the fullest extent permitted (if at all) by applicable law, any amount unpaid at the end of thirty (30) days is subject to interest at the lesser of the maximum rate permitted by law or one and one-half percent (1.5%) per month on the unpaid balance. If unpaid amounts are collected through legal proceedings or by an attorney, Customer shall pay reasonable costs and attorneys' fees or agents' fees associated with such collection procedures or efforts.

11.Cancellation. Customer may cancel any order for services hereunder subject to payment for all service rendered and out-of-pocket expenses incurred up to date of cancellation in accordance with the applicable Price Schedule.

12.Taxes. Any tax or levy, whether now in force or enacted or levied in the future, except a tax based on Core's net income, based on or measured by the charges for the services furnished hereunder shall be in addition to the charges specified in the Price Schedule and shall be paid by Customer. All taxes, duties, or other governmental charges assessed outside the United States shall be reimbursed by Customer.

13.Severability. Should any provision of the Terms be held invalid, illegal or unenforceable, such action shall not affect any other provision of the Terms.

14.Waiver. Failure by either party to enforce any of the Terms in any particular instance shall neither constitute a waiver of its rights under this Agreement, nor shall it constitute a continuing waiver or preclude subsequent enforcement thereof.

15.Legal Construction,Interpretation and Venue. This Agreement shall be governed by and interpreted in accordance with the laws of the State of Texas, exclusive of procedural rules for choice of applicable law. The rights, duties and obligations described herein arose in and are performed in Harris County, Texas.

16.Assignment. This Agreement shall not be assigned by Customer without the prior written consent of Core.

17.Force Majeure. Core shall not be responsible for delay or failure to perform the services pursuant to this Agreement due to causes beyond its control.

18.Overriding Agreement. The parties agree that the Terms shall govern performance of Customer's initial order and all subsequent orders for additional services, whether placed in writing or orally, except to the extent the Terms are modified in writing and executed by an authorized representative of each party.

19.Entire Agreement. The Terms and any applicable Price Schedule represent the entire Agreement of the parties. Core shall not be bound by any prior or contemporaneous oral or written understanding, agreements, and/or Customer purchase orders with respect to the service to be performed pursuant to this Agreement.

20.Agreement Modifications. Changes, modifications or amendments to the Terms shall be effective only if in writing and executed by an officer of Core and by Customer's authorized representative, except that subsequent orders for additional services may be oral or in writing.

21.Witness Fees. Should Core or any of its employees be called to testify (whether at a trial, deposition, administrative proceeding, or other use), participate in discovery, or otherwise assist in any dispute between Customer and any third party with respect to any of Core's work or services, and whether or not Core or its employees shall have been subpoenaed to testify or assist, Customer shall pay Core's then current applicable rates, charges, and other fees for such services.

22.No Third-Party Beneficiaries: No Right of Reliance. Core shall have no responsibility or liability for Customer's use of or reliance on the data, information, or reports furnished by Core. Customer is securing services hereunder for his own account, and not as an agent or broker, or in any other representative capacity, for any other person or entity. It is agreed and acknowledged that there are no third party beneficiaries to this Agreement, and that no third party may rely on such data, information, or reports. Customer represents, warrants, and agrees that said data, information, and reports are not requested, nor shall be used or relied upon, in connection with or as part of, the purchase, sale, underwriting, or distribution of any securities, any periodic or other reporting to the holders of any securities, the securing, amendment, renewal, or extension of any loan from any financial institution or other lender, or the certification to or contracting with, directly or indirectly, any governmental agency or department.

CORELAB

CORE LABORATORIES